Patent claims

1. A method for analyzing body fluids, characterized in that an image recording device (30) is used to produce at least one image of the body fluid (21) located in a container (20) that is analyzed by means of image processing software.

2. The method as claimed in claim 1, characterized in that firstly the type and size of the container (20) are determined automatically.

3. The method as claimed in claim 2 or 3, characterized in that an image of the container is produced with the aid of the image recording device (30), and is compared with the aid of evaluation software with stored image files and/or dimensions of known containers.

4. The method as claimed in claim 3, characterized in that the caps of the tubes (30) holding the body fluid are compared, and the type of tube and height of tube are determined thereby.

5. The method as claimed in one of claims 2 to 4, characterized in that after determination of the type and size of the container (20) the latter is moved automatically in such a way that as complete an image as possible of the body fluid can be produced by means of the image recording device (30).

6. The method as claimed in one of the preceding claims, characterized in that the container (20) is moved automatically such that as complete an image as possible of the body fluid can be produced.

7. The method as claimed in claim 6, characterized in that a scanner and/or image evaluation software are

provided for detecting an inscription placed on the container (20), a label and/or a cover (27), and in that the scanner detects the bar code and the image evaluation software detects the edges of the cover (27), and the container (20) is moved automatically such that the cover (27) is situated on the side of the container (20) averted from the image recording device (30).

8. The method as claimed in claim 7, characterized in that following the optical blanking out of a cover (27) the container (20) is covered on the side averted from the image recording device (30).

9. The method as claimed in claim 8, characterized in that 15 to 50%, preferably 20 to 25%, of the outer surface of the container is covered.

10. The method as claimed in one of the preceding claims, characterized in that the image recording device (30) is used to produce simultaneously an image of the body fluid in a first container and an image of a subsequent second container for the purpose of determining the type and size of the second container.

11. The method as claimed in one of the preceding claims, characterized in that a color image of the body fluid and of the container is produced.

12. The method as claimed in claim 11, characterized in that the color image of the body fluid and/or of the container are/is converted automatically into a gray value image.

13. The method as claimed in one of claims 11 or 12, characterized in that for the purpose of detecting the type and size of the container, a number of vertical lines are laid in the image of the container, the color values and/or brightness values of the pixels lying on

these lines are detected, and changes in color value and/or brightness value are determined and compared with the data of known containers.

14. The method as claimed in claim 13, characterized in that the handling apparatus is controlled with the aid of the data determined for the container.

15. The method as claimed in one of the preceding claims, characterized in that one or more detail images are produced that are combined by means of the image processing software to form an overall image.

16. The method as claimed in one of the preceding claims, characterized in that for the purpose of evaluating the image of the body fluid, a number of perpendicular and/or horizontal lines are laid in the image of the body fluid, the color values and/or brightness values of the pixels lying on these lines are detected, changes in color value and/or brightness value are determined, and the background region and/or upper edge (55) of the body fluid are determined.

17. The method as claimed in claim 16, characterized in that the background region is removed from the image computationally.

18. The method as claimed in one of the preceding claims, characterized in that in order to identify the separating means (25) and/or the blood clot (26) in a centrifuged sample of body fluid, each pixel row of the image is scanned from bottom to top, and the transition from dark color or brightness values to brighter color or brightness values is detected and defined as phase boundary between blood clot (26) and a separating means (25) or between the separating means (25) and serum (21).

19. The method as claimed in claim 18, characterized

in that the image region determined for the separating means (25) and/or the blood clot (26) is removed from the image computationally.

20. The method as claimed in one of the preceding claims, characterized in that in order to identify blood serum/plasma (21) and/or separating means (25) and/or blood clot (26) by means of the region-grow method, regions of pixels with similar color values are determined, and the resulting regions are defined as serum (21), separating means (25) and/or blood clot (26).

21. The method as claimed in claim 20, characterized in that in order to detect solid particles in the serum and/or plasma (21), the region corresponding to the serum (21) is compared with stored color values of reference samples and classified as "clear" or "not clear".

22. The method as claimed in claim 21, characterized in that in order to identify solid particles in the serum and/or plasma (21), the region corresponding to the serum (21) is compared with stored color values of defined solid particles in reference samples, and classified in terms of shapes or colors, for example "red clots" and "white clots".

23. The method as claimed in claim 20, characterized in that the blood clot and/or the separating means are/is removed from the image computationally.

24. The method as claimed in claim 20 or 21, characterized in that in order to determine the volume of the blood serum (21), upper and lower limits of the serum region are determined automatically, and the volume is calculated automatically with the aid of the diameter of the container (20).

25. The method as claimed in one of the preceding claims, characterized in that the color value is determined for each pixel for the purpose of color analysis of the serum, is compared with stored color values of classified reference samples, and is classified as "good" or "not good".

26. The method as claimed in claim 24, characterized in that the comparison is undertaken in a color space, preferably in a "CIE Lab" space.

27. The method as claimed in claim 24 or 25, characterized in that the serum is classified overall as "good" when the majority of the pixels are classified as "good", and in that the serum is classified overall as "not good" when the majority of the pixels are classified as "not good".

28. The method as claimed in one of claims 21 to 27, characterized in that the handling apparatus is controlled with the aid of the classification determined for the serum such that "good" and/or "clear" samples are passed for further analysis, and "not good" and/or "not clear" samples are rejected.

29. The method as claimed in one of the preceding claims, characterized in that images of known samples are produced, classified into classes and stored in data file/files in order to produce reference data.

30. The method as claimed in claim 29, characterized in that color features are extracted at least once for all the images of the individual classes.

31. An apparatus for analyzing body fluids, characterized in that an image recording device (30) is provided and is connected to an electronic image evaluation apparatus.

32. A computer programmed for carrying out the method as claimed in one of claims 1 to 30.

33. The apparatus as claimed in claim 31 that includes at least one computer as claimed in claim 32.

34. A digital storage medium having electronically readable control signals that can cooperate with a programmed computer system such that a method as claimed in one of claims 1 to 30 is executed.

35. The storage medium as claimed in claim 33 that has control software for controlling an apparatus as claimed in claim 31 or 33.

36. The storage medium as claimed in claim 35 that has image processing software for analyzing images.

37. A computer program product for carrying out the method as claimed in one of claims 1 to 30 after implementation in a computer as claimed in claim 32.

38. The computer program product as claimed in claim 37, specifically control software for controlling an apparatus as claimed in claim 31 or 33.

39. The computer program product as claimed in claim 37, specifically image processing software for analyzing images.

40. The computer program product as claimed in one of claims 37 to 39 that is stored on a data carrier, in particular a hard disk, a floppy disk, a CD ROM or a storage tape.